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ABSTRACT

The Diffusion of Appropriate Educational Technology in Open and Distance Learning in Developing Countries project was designed to determine awareness and use of educational technologies and communications media in developing countries, to identify factors constraining wider use of educational technologies by developing nations, and to explore possible solutions to the problem. The project consisted of the following phases: (1) a literature search and document review; (2) surveys and in-country research of selected programs and institutions; and (3) field study trials in eight countries in Africa, Asia, the Caribbean, and the Pacific. The following were among the factors constraining wider use of educational technology: lack of skilled personnel, data transmission lines, and Internet service providers; lack of policy and coordination; high costs of technology; and inadequate demonstration of courseware's pedagogical value. The field trials demonstrated the following things: (1) training in new systems is essential for their use; (2) users who are informed of the benefits of change are more likely to consider it seriously and support its adoption; and (3) change requires policy and vision. The study yielded specific recommendations regarding the following areas: strategic policy and planning; research and knowledge bases; and developing and demonstrating new approaches and models and offering training to support them. (MN)

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ED 464 237

Diffusion of Appropriate Educational Technology in Open & Distance Learning in Developing Commonwealth Countries.

Final Project Report

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Diffusion of Appropriate Technologies for Distance and Open Learning.

Contents

	Page
1. Executive Summary	7
2. Overview of the Project	13
3. Issues and Questions for Further Research	21
3.1 Countries as Information Societies	23
3.2 Learning Institutions	29
3.3 Connections for Learning	33
4. Conclusions and Recommendations.	52
Appendices	55
UNCSTD Recommendations	55
References	56

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And I would also like to thank my colleague Mr Nick Short, at the Internet Learning Trust in the UK for discussions on these issues, and the opportunity to engage with this project.

1. Executive Summary

Introduction

The goal of the Diffusion of Appropriate Educational Technology in Open & Distance Learning in Developing Commonwealth Countries project was to systematise some of what was known anecdotally, primarily for developing countries. It aimed to investigate why and how various factors seem to impede the wider and more effective use of educational technologies, and what environments would be more conducive to their use. It took place over the years 1996-2000.

Aims

The aims of the project were:

1. To assess
- The use of educational technologies and communications media,
- The awareness of their potential
- Factors constraining wider use
- The impact of new technologies

2. And to explore possible solutions and strategies.

Process

The project consisted of three phases: literature search and document review, survey and in-country research of selected programmes and institutions, and field study trials. The project has been successful in identifying a broad and fairly inclusive range of these factors.

- Policy (in telecommunications and broadcasting);
- Attitude of administrators and academics
- Absolute (add-on) costs
- Culture and availability of English and indigenous language materials.
- Macro-economic planning, and particularly investment strategies and commitments
- Restructuring and change management, and flexible resource management and decentralisation
- Access to telecommunication networks
- Training
- Awareness of local potential of media.
- Hardware facilities, skills and technical support

The survey consisted of two phases: a survey of administrators and academics attitudes to educational technology and barriers to the diffusion in selected developing Commonwealth countries, and in-country research regarding selected barriers to the diffusion of educational technology within those countries.

The surveys were carried out in:

- Africa: Ghana and Tanzania
- Asia: India, Malaysia, Maldives
- Caribbean: Guyana
- Pacific: Papua New Guinea, Solomon Islands.

This was followed by the field trials phase, which decided to trial each of these in one county: Ghana, Guyana, India and the Solomon Islands. The Solomon Islands trial was unfortunately cancelled because of unrest.

Overall Results and Trends

The overall trends were:

- All regions face a lack of skilled personnel, data transmission lines, and Internet Service Providers (ISPs).
- Africa needs more infrastructure, particularly in telecommunications. Broadcasting should continue to be used in the interim.
- Asian infrastructure is good, but it should be more widely utilised, for culturally appropriate learning.
- The Caribbean is said to be enthusiastic about multi-mode delivery.
- The Pacific has good infrastructure, but need more policy and coordination..
- Software: Public – private partnerships could assist for software development (i.e. courseware).
- Hardware and networks: Non-networked solutions are advocated, in the absence of infrastructure. Long term implications need to be spelt out, as well as hybrid/growth and development strategies.
- Inhibiting factors are:
- Costs - by which is meant additional costs, are seen to be the major problem.
- Access to services.
- Pedagogical value of courseware does not seem to have been demonstrated widely.

Field Trials

In addition, the field trials showed that:

- Training in new systems is essential for their use
- If users are informed of the benefits of change, they will be more likely to consider it seriously and work to support its adoption
- Policy and vision is necessary for change, and for the management of complex systems, such as multi-channel ODL (Open & Distance Learning).

Issues and Questions for Further Research

The issues and questions for further research that follow from the project gave rise to a number of particular questions, concerning:

- Country status and strategy as an information/knowledge society
- Institution status and strategy as a learning institution, and potentially as a digital/e-learning institution
- Macro critical change factors, and the way they impinge on learning institutions.

Additional sources were consulted, the issues were re-examined and where necessary re-formulated, and some strategic tools have been put together to provide an initial framework for dealing with some of these issues. These tools include the Mansell and Wehn *Footprints of country participation in Knowledge Societies*, and the *Connections for Learning Maps* for linking strategies on learning systems and learning outcomes.

Recommendations

There are three broad areas in which the work of the project should be taken forward:

- Strategic Planning and Policy
- Research and Knowledge Bases
- Developing and demonstrating new approaches and models, and offering training and support for them.

Strategic Planning and Policy

The combination of the Mansell and Wehn *footprints*, and the Connections for Learning *maps* should enable countries, institutions, educators and even learners to develop strategies and policies based on an analysis of the learning opportunities they want to develop, and their relationship to possible developments in a variety of alternative systems. What is important is to be able to make decisions on the trade-offs between the alternatives: in learning outcomes, in systems/technologies and media, and between the two.

The *footprints* are important at a country and international level, and would serve the strategic needs at a Departments of Trade and Industry and at a macro-economic level. The *maps* also contain information and indices on infrastructure. However, these have been selectively "transcribed" to provide a systems perspective for connections **for learning,** and management issues have been added: institutional, ICT, and human resource management.

This makes up a *map* with two halves – the Learning Environment, and Systems. When they are juxtaposed in this way, strategies can be discussed across systems/ learning/ and management issues. The development (and "diffusion") of learning can be analysed and

planned at learning programme, institution, and country level. In terms of Government Ministries, this map should facilitate an integrated discussion on learning strategy between all the Ministries involved in learning and in systems and infrastructure.

Research and Knowledge Bases

Research

There is a need for further research. At a micro level best practices still need to be documented, analysed and evaluated. At a systems levels there is, if anything, a much greater need to research *best strategy* rather than just best *practice*. A strategic evaluation (or impact analysis) needs to take all of the following into account: costing, financing, technology and systems, access, and the value of the learning. The new media environment makes it possible to do so many interesting things. The question is: Which of them are appropriate - for the present time, and to form a basis for future developments?

Knowledge Bases

There are always opportunities for building knowledge bases. But the question of appropriacy applies here too. At a relatively simple level, it would be possible to consider the following parallel developments:

The development of a set of strategic evaluation and planning tools. The *footprints* and *maps* could form the basis for this. They should of course be revised and developed and added to if necessary. They can be made available as a series of diagrams and texts.

Alongside these texts and diagrams - quite literally: on one side of the screen (on-line or off-line on CD-ROM media), it might be useful to set up a series of icons, just like the ones around any standard word processing screen, which would link to a series of examples of best practice (and best strategy). These icons could link to examples by: country, region, media & technologies, institution, government sector, types of communities (rural, peri-urban, etc), and education and training sectors.

This might usefully inform the conceptual and analytical texts in the strategic tools. It could be made available on- and off-line, at little cost, and updated in the off-line version a few times a year.

The Diffusion of Technologies project has explored a number of factors, and the questions and issues that have arisen from the project point the way to some useful areas of future work: in strategic planning, in research, and in the related development of knowledge bases.

Demonstrating new approaches and models, and training.

There is a demonstrable benefit to assisting institutions to consider, plan, and develop new approaches to learning, using different combinations of technologies and media.

The field projects demonstrated the value of raising awareness of new technologies and combinations of technologies. These projects as well as the work of the Commonwealth of Learning in other projects demonstrates the value of assisting people to take the next steps too: to do needs analyses, feasibility studies, and start-up and support, in order to build and demonstrate models of effective learning.

The crucial issue is to ensure that both the new development, and further training and support are sustainable, within a well costed, long-term scenario.

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2. Overview of the Project

Introduction

The goal of the Diffusion of Appropriate Educational Technology in Open & Distance Learning in Developing Commonwealth Countries project was to systematise some of what was known anecdotally, primarily for developing countries. It aimed to investigate why and how various factors seem to impede the wider and more effective use of educational technologies, and what environments would be more conducive to their use. It took place over the years 1996-2000.

The aims of the project were:

1. To assess
- The use of educational technologies and communications media,
- The awareness of their potential
- Factors constraining wider use
- The impact of new technologies

2. And to explore possible solutions and strategies.

This can be restated as:

> **An investigation into the critical success factors for the widespread and effective use of appropriate educational technologies and communications media.**

Process

The project consisted of three phases: literature search and document review, survey and in-country research of selected programmes and institutions, and a field study, (framework for field trials, and the field trials themselves).

The critical factors that were identified and investigated varied according to the various stages. In the various stages:

The Terms of Reference identified:

- Policy (in telecommunications and broadcasting);
- Awareness and attitude;
- Absolute costs; and
- Culture.

The Literature review added:

- Macro-economic planning, and particularly investment strategies and commitments
- Restructuring and change management, and flexible resource management and decentralisation
- Technical support and skills
- Access to telecommunication networks
- Training.

The Literature Review stated that:

> A notable development in the diffusion [of technologies] literature is the emergence of the concept of "Appropriate Technology". Concern for more realistic approaches to the evolvement or adoption and diffusion of technology compatible with the conditions in developing societies led to the formulation of the concept.

The Research Survey: The regional surveys decided to focus on particular issues:

- Policy (in telecommunications and broadcasting);
- Awareness and attitude;
- Utilisation of technology
- Absolute costs; and
- Language issues

The survey in turn consisted of two phases: a survey of administrators and academics attitudes to educational technology and barriers to the diffusion in selected developing Commonwealth countries, and in-country research regarding selected barriers to the diffusion of educational technology within those countries.

The surveys were carried out in:

- Africa: Ghana and Tanzania
- Asia: India, Malaysia, Maldives
- Caribbean: Guyana
- Pacific: Papua New Guinea, Solomon Islands.

The returns on the survey were poor. The overall response rate was 12.7%, but in some categories the response was less than 10% (e.g. the Pacific region) so these results were not analysed further. The results must be treated as qualitative and indicative, and not quantitatively significant.

The results of the survey of administrators and academics were:

Experience with technology

Asian respondents and those in the technical & vocational fields reported the most use of technology. Administrators have more experience than academics.

Use of Educational Technology

In general, administrators use the technology more. Academics need more opportunity, and more support if they are to use the technology.

Future Use of Technology

African administrators were least enthusiastic, Asian academics most.

Barriers to the Use of Technology Now

Cost was seen as the biggest barrier. In Africa pedagogical effectiveness still has to be demonstrated.

Past Barriers to Use of Technology

These were varied, and in general not a predictor of current use or attitudes. This seems to show that the use of technology is changing rapidly.

The results of the survey of the in-country research were:

Funding for technology

The Pacific has little, Africa some, and Asia the most investment.

State Policy to support diffusion

The same pattern as for funding (above). Development of policy might assist here.

Agencies to promote the use of technology

Varied: Within the same trends as above.
Some of the specific agencies were:

- Pacific: Only broadcasting, for primary and secondary.
- Tanzania: Radio across all education sectors
- Ghana: Radio in K-12 and non-formal; computer use in primary, secondary and tertiary.
- Asia: In general, all sectors covered, for all technologies.

Indigenous software production

Very little data, and seemingly very little activity. This could have changed since then, particularly with the growth of the more general software industry in India.

Technology penetration by community and household

In Asia this was high, and Africa very low. Surprisingly perhaps, the reported penetration was highest for all technologies in the Pacific.

Overall trends

The overall trends were:

- All regions face a lack of skilled personnel, data transmission lines, and Internet Service Providers (ISPs).
- Africa needs more infrastructure, particularly in telecommunications. Broadcasting should continue to be used in the interim.
- Asian infrastructure is good, but it should be more widely utilised, for culturally appropriate learning.
- The Caribbean is said to be enthusiastic about multi-mode delivery.
- The Pacific has good infrastructure, but need more policy and coordination..
- Software: Public – private partnerships could assist for software development (i.e. courseware).
- Hardware and networks: Non-networked solutions are advocated, in the absence of infrastructure. Long term implications need to be spelt out, as well as hybrid/growth and development strategies.
- Inhibiting factors are:
- Costs - by which is meant additional costs, are seen to be the major problem.
- Access to services.
- Pedagogical value of courseware does not seem to have been demonstrated widely.

Field Trials

The framework for the field trials was designed by the same person who did the literature search, and it differs slightly from the previous phase (the regional surveys), as well as from some of the parameters cited in the literature search. It focused on:

- Policy (in telecommunications and broadcasting);
- Awareness of local potential of media.
- Hardware facilities, skills and technical support, and
- Training

The field trials phase decided to trial each of these in one county: Ghana, Guyana, India and the Solomon Islands. The Solomon Islands trial was later cancelled because of unrest.

The outcomes and conclusions of the final phase (phase three) of the project are:

	Phase Three	Field Trials	
	Asia: India	**Caribbean: Guyana**	**Africa: Ghana**
Intervention	Training Regional Centres in use of email and Internet	Seminar on application of new technologies to ODL	Policy workshop: public and private sector.
Outcomes	More use of email and Internet	No immediate benefit, but awareness of potential benefits established.	Awareness of need for policy, and plans to develop it.
Conclusion	Training in new systems is essential for their use	If users are informed of the benefits of change, they will be more likely to consider it seriously and work to support its adoption.	Policy and vision is necessary for change, and for the management of complex systems, such as multi-channel ODL.
Comment	The intervention did ensure that the outcomes occurred, but the training should have been part of routine management. Multiple causes are likely to be responsible for some of this change.	No systems development and support in sight. Increased awareness was positive, and needs to be followed-up.	First steps in place. Needs follow-up of planning, costing, and management (training) to have impact.

Critical Success Factors

The table below summarizes the critical success factors in the phases of the project, (TOR: terms of reference; Literature Review; Roberts Survey; Framework (for the Field Trial); Field Trial; and gives an indication of the critical success factors that are important to the diffusion of technology in the column "Overall".

There are some factors which is not included in the Overall column:

Attitude: This might better be dealt with under "awareness", which is really a change management issue. People's awareness is often a derivative of other factors, such as ignorance of potential, of best practice elsewhere, of basic competence, of costings which indicate its overall and long term benefit.

Absolute costs: These are obviously pertinent, but it would be better to deal with this too under "costing" and financial planning. Short term additional costs are never welcomed, and seldom possible. Without proper costing and financial planning over the longer term, these cannot realistically be considered.

The last section of the table is structured differently. It is structured according to learning needs rather than technological requirements. It could be used as a tool to analyse current practice, and plan and strategise for the future.

Critical Success Factors for the Diffusion of Technology, identified in each of the phases of the project, and an 'overall' conclusion column.

	TOR	Lit. Review	Roberts Survey	Frame-work	Field Trial	Overall
Policy		X	X	X	X	X
Telcoms and Bc networks and tariffs	X	X	X			X
Educational						X
Economic development: Information Society						X
Macro-economics		X				X
Investment		X				X
Country and provincial analyses						X
Awareness & Attitude	X					X
Awareness of local potential					X	X
Attitudes of:				X		
Academics			X			
Administrators			X			
Cost						
Absolute, add on.	X		X			

Critical Success Factors for the Diffusion of Technology (cont.)

Management						
Institutional management						X
District and country co-ordination (private/public sector)						X
Costing						X
Cost centres						X
Business plans						X
Planning and management in multi-mode ODL						X
Restructuring and change management		X				X
Flexible resource management and decentralisation		X				X
Impact assessment						
Hardware						
Facilities				X	X	X
Technical support and skills		X		X	X	X
Software						
Resource management tools						X
Content development tools						X
Content Development training						X
Courseware			X			X
Private/public partnerships			X			X
Access:						
To Telcom network		X				X
Line costs						X
ISP networks			X			X
Cost effective access						X
Broadcasting coverage						X
Broadcasting licensing (local radio)						X
Interaction						X
Search facilities & training						X
Knowledge bases and support services						X
Culture	X					
English language materials						X
Local language materials.			X			X
Training		X		X	X	X
Using new/existing systems		X		X	X	X
Developing models: Design, start up, support						X

Critical Success Factors for Distance and Open Learning.

Media	Face to face	Print	Radio	Tele-vision	CD/ DVD	email	Inter -net
Factors impacting on D&OL							
Policy							
National Policy							
National Investment							
Institutional Policy							
Management							
Institutional Investment & change management							
Awareness							
Costing							
Training							
Design and production of interactive materials							
Contact, distribution of materials, updates, searches and access to information.							
Administration & Tracking							
Mediated learning: interaction and support:							
Tutor to student							
Peer to peer							
Broader interaction							
Feedback and formative assessment: quality, time, interaction							

3. Issues and Questions for Further Research

Arising out of the Diffusion of Technologies project are a number of issues, and a number of questions for further research. These are:

- How to define a country's actual and potential status as an information society
- How to facilitate its strategy for the development of critical success factors.
- How to define a Distance/Open Learning Institution's actual and potential status as a virtual institution
- How to facilitate its strategy for the development of critical success factors.
- How to define and track macro critical change factors, and the way they impinge on learning institutions.
- How to facilitate strategy for responding to these factors.

The country issues will be dealt with based on the work in the Mansell & Wehn [ed] (1998) book, *Knowledge Societies*. The Learning Institution issues will be dealt with in a matrix called Connections for Learning. The critical change factors will be dealt with throughout this section.

Countries as Information Societies.

The Mansell & Wehn [ed] (1998) book, *Knowledge Societies* states that:

> Advanced micro-electronics based information and communication technologies (ICTs) are at the heart of recent social and economic transformation in both the industrialised and many developing countries. ... Developing countries are being encouraged to invest in their national information infrastructures so that they can participate in knowledge-based development and experience the predicted social and economic benefits (p1).

Their book is a very useful, broad and detailed, overview and analysis of available data on how countries are (or are not) investing, and how this might be the basis for the much vaunted benefits.

In Chapter two, the data is used to construct a model which "pictures" (very usefully, in a single diagram or "footprint") all of the factors which they identify as being pertinent to investment and development, and participation in, a knowledge society.

They deal with issues which are key to the purpose of this part of this report, which is to compile a set of strategic tools for the development of learning institutions and learning societies.

First of these is to set out broad parameters of "convergence" or "catch-up", by which they mean the number of years that different types of countries will take to converge with the lowest current level of telecommunications infrastructure in developed (G7) countries.

Table 2.4 Convergence in telecommunications (p25).

Convergence period	Groups of Countries
Advancing at the frontier, or nearly converged	Developed countries, First Tier Newly Industrialised Countries (NIEs).
A Decade (10 years)	Second Tier NIEs, China (highly optimistic), European developing countries, West Africa
A generation (15-20 years)	Eastern Europe, China (more realistic), Other Asia, Mahgreb, Caribbean, South America
Out of sight (50-100 years)	Sub-Saharan Africa, Central Asia.

The second is to set out norms for constructing Indicators for Footprint Analysis. The norms that are set for what will be the edge of the circle of the "footprint" are set a 100, but the norms are not absolute, nor are they taken as the extreme on the globe. Rather, they are taken precisely as norms, and they do correspond more or less to particular countries, which are norms in terms of developed countries (about 31 of them).

Table 2.12 Construction of Indicators for Footprint Analysis (summarised: p37).

Indicator/Index	Computation	Country @ "100"
Personal computers	Personal computers per capita	New Zealand
Main Lines	Telephone lines per capita	Sweden
Electronics Production	Electronics revenue share of GDP	Ireland
Electronics Consumption	Per capita consumption as share of GDP per capita	Ireland
Technical Graduates	Computer Science, Math, Engineering graduates per 1,000 population	The Netherlands
Literacy	None: Simple percentage of population	100% taken as 100
Internet Hosts	Internet hosts per 1,000 population	Denmark
Television Sets	Sets per 1,000 population	UK

The third is to set out the indicators or indexes on a single diagram or "footprint" which gives a clear picture of the strengths, weaknesses, and country strategies (implicit or explicit) of each country.

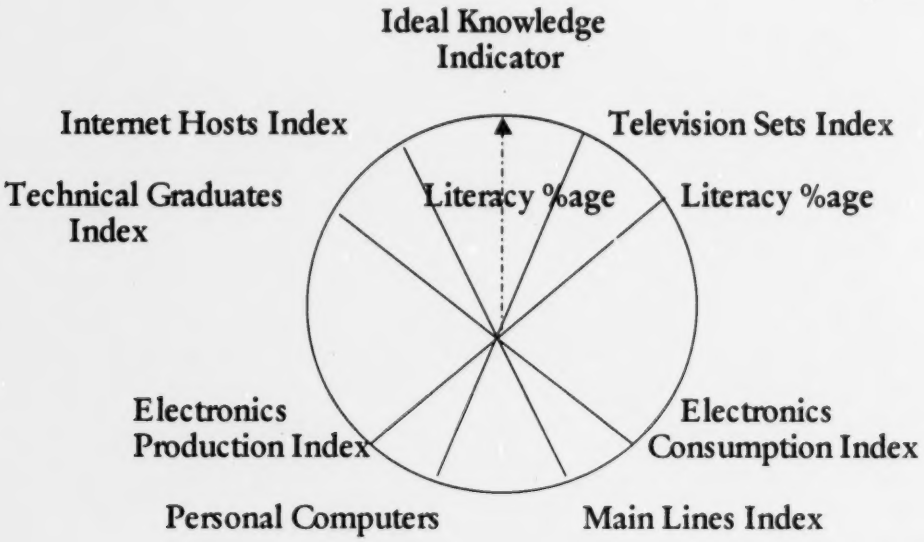


Figure 2.9 Graphing Method for Footprint Analysis.

The application of this footprint analysis is applied to a number of countries, some of which are included below:

FIGURE 2.11 - CHINA AND INDIA FOOTPRINTS

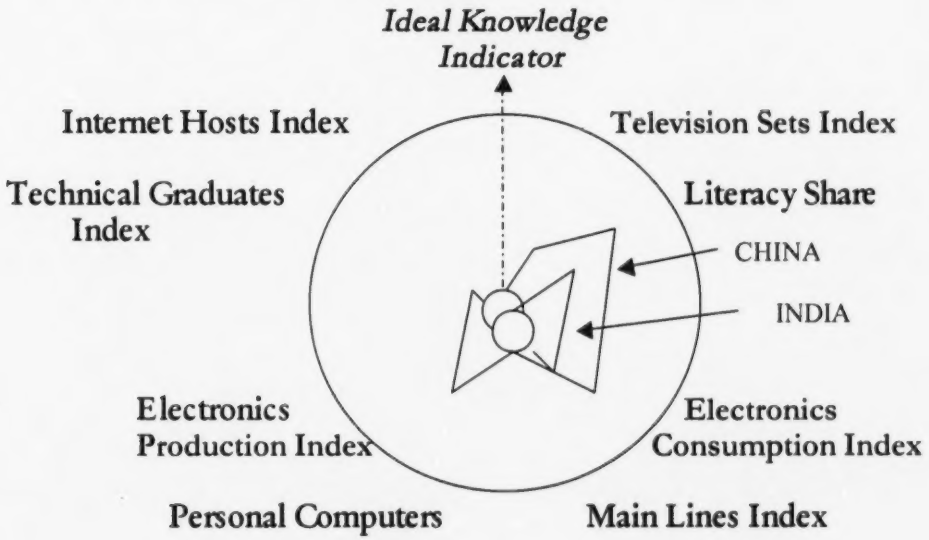


FIGURE 2.13 - POLAND AND SPAIN FOOTPRINTS

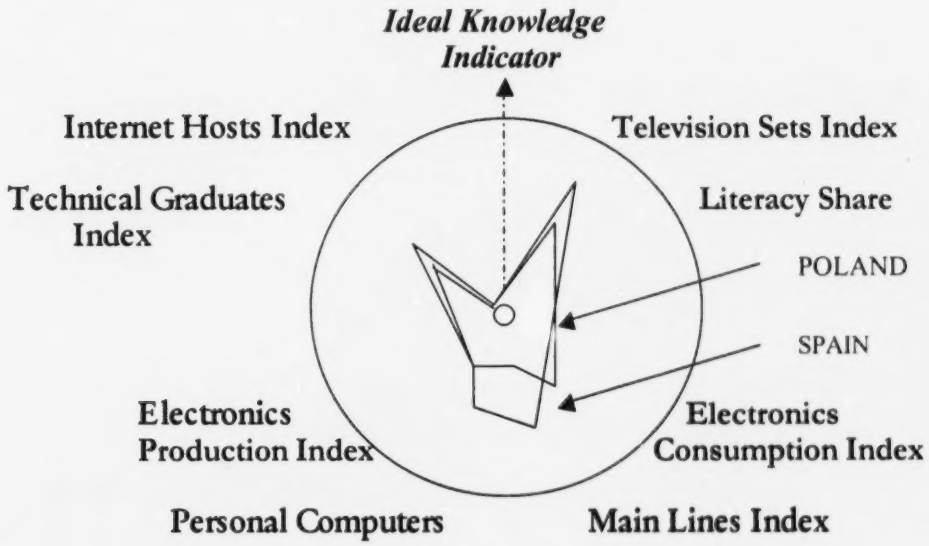


FIGURE 2.14 - TURKEY AND SOUTH AFRICA FOOTPRINTS

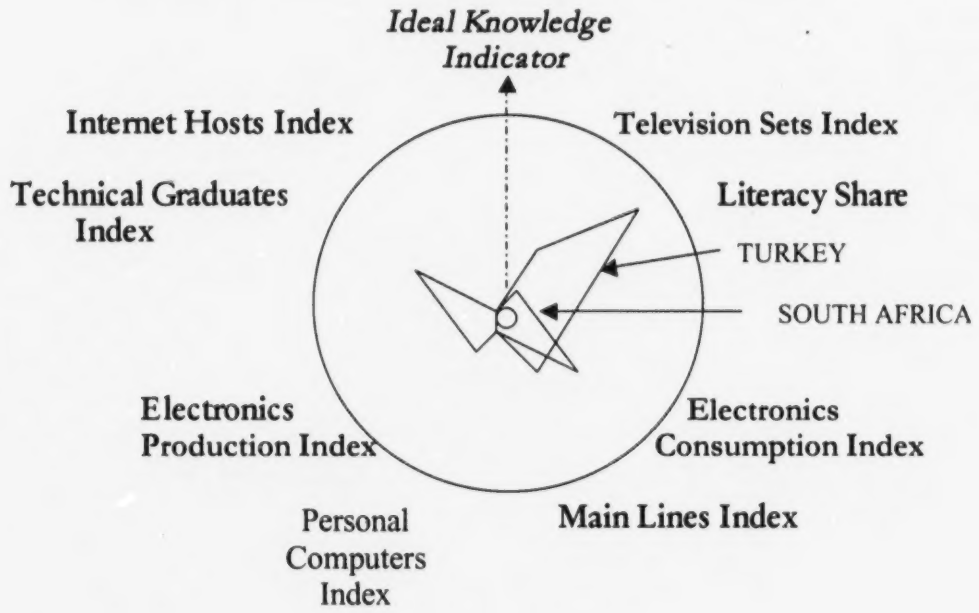


FIGURE 2.15 - PHILIPPINES AND PUERTO RICO FOOTPRINTS

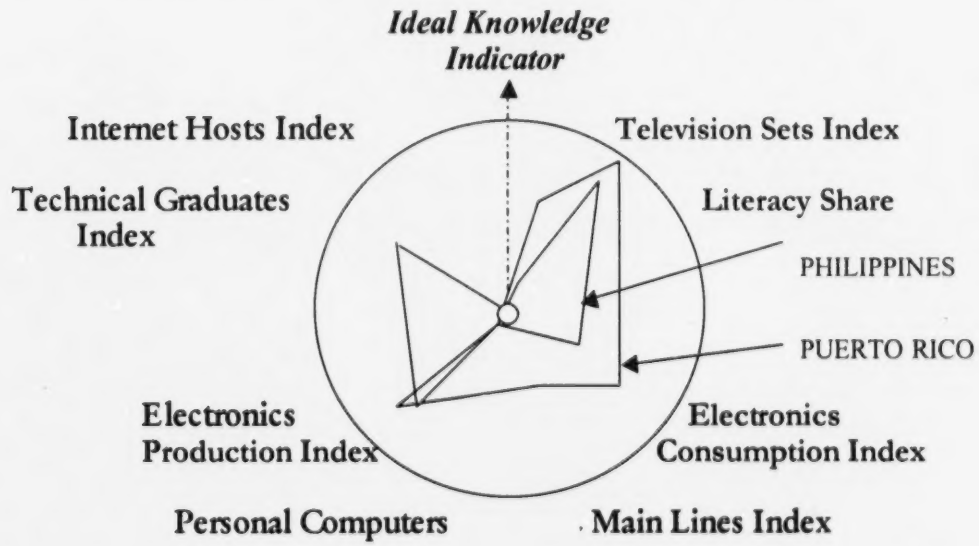


FIGURE 2.12 - RUSSIA AND BRAZIL FOOTPRINTS

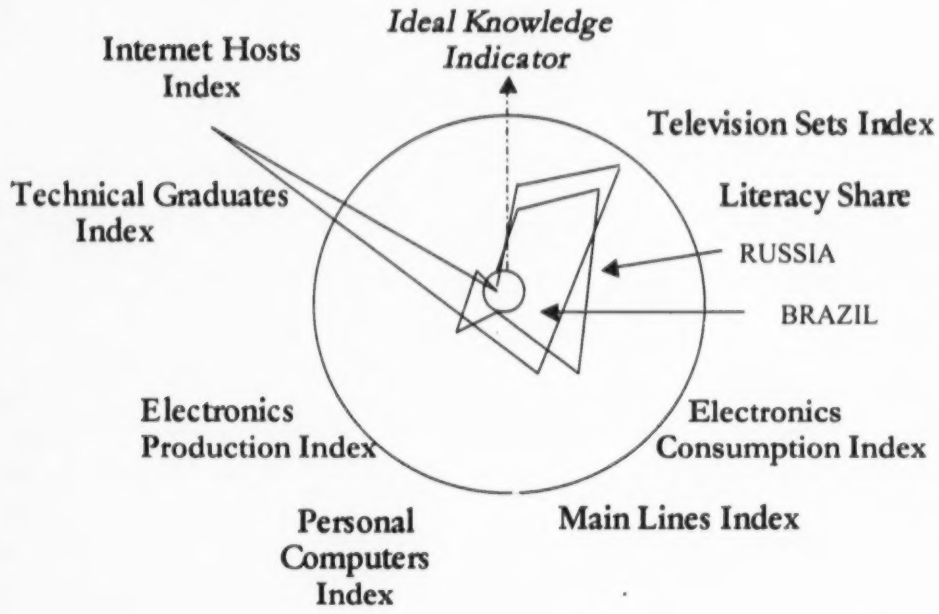
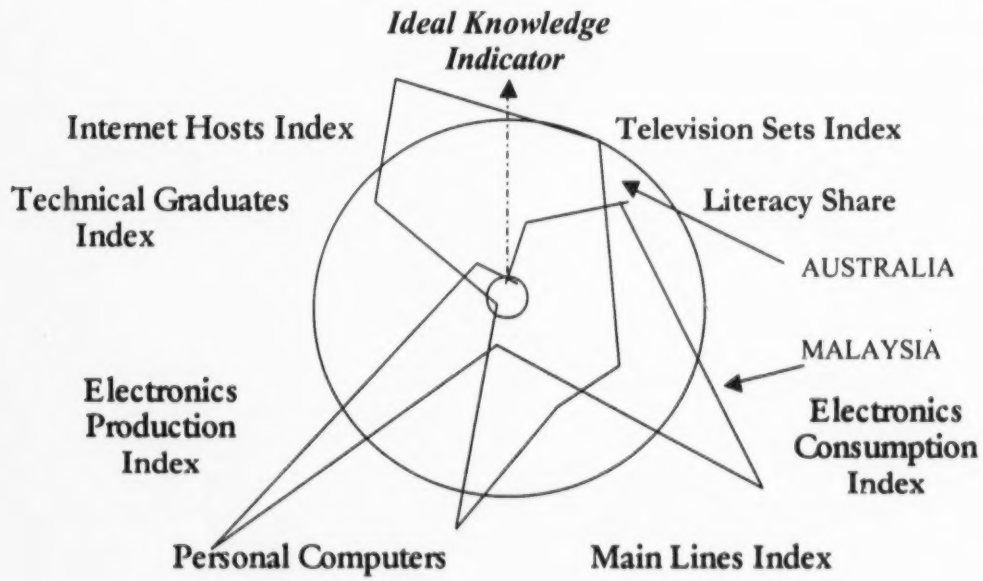


FIGURE 2.16 - AUSTRALIA AND MALAYSIA FOOTPRINTS



3.2 Learning Institutions

The question asked at the commencement of the Diffusion of Technology project, namely:

> What are the factors preventing the diffusion of technology for distance learning?
>
> could usefully be rephrased as:
>
> What are the critical success factors for the "diffusion" of learning, and how can various combinations of technologies be of use?

It is generally agreed that technologies vary in their usefulness according to context and function, and that developments must be driven by the learning objectives. It is also the case that it is the right *combination of* technologies, rather than the right *technology* that is important. And there are so many different options now available, and each on-line and off-line option has its own benefits and limitations.

However, the potential of convergent digital information and communication technologies, particularly with the addition of Internet type platforms (on-line and off-line) offers economies and efficiencies of scale which are so different from the "incumbent" technologies and so advantageous that they have to be implemented in some form or another.

At a macro-economic level, Alan Greenspan (2000) declared that ICT technologies were responsible for the unprecedented sustained growth period in the US (and other economies) at the turn of the twenty first century.

Mansell and Wehn point out that few if any countries can afford the opportunity costs of **not** developing a digital economy, and quote Drucker (1994:62,64) who says that:

> Developing countries can no longer expect to base their development on their comparative labour advantage. [What] now counts is the application of knowledge.

The pressure to develop digital capacity and services is now urgent both in terms of the internal benefits for institutions, and in terms of the external threats of competition from other institutions globally. Distance education institutions, in particular, have pronounced opportunities and threats in this field.

The question then is:

> **What is the appropriate form and strategy for such development, and what are the key learning objectives and priorities that should determine this development?**

In other words, not a matter of "if" but of "when" and "how". This is not to say that all institutions should become fully digital in the short term. But it is to say that all their long term plans need to include substantial digitalisation in some form or another. Old media

(like radio) do not die, they just find new niches, and eventually expand and flourish in those niches.

This section will start by outlining the potential that digital ICTs offer, focusing primarily on learning and the management of learning, which can be achieved by the use of a variety of different combinations of technologies. The outcome of this process will be a document and a "map" which should be of use in strategic planning and management for the development of learning, with the development of technologies coming up in support, and not vice versa.

Virtual Organisations

The potential of the use of digital technologies for learning is tied up with the discussion of "virtual" organisations. We need to get some idea of what "virtual" organisations are, and even what virtual/information societies are, and what is meant when people say that they are **inherently** desirable.

At the most general level, we need to consider that:

- If it is true that the value of an institution is more than the sum of its parts, then the connections between its parts are key factors for its success, and:

- If particular information and communication systems can make these connections more flexible, efficient, and effective, then that will result in a better as well as a more competitive institution.

We need to get some idea of where the expectations come from, that Distance/Open Learning institutions *should* be virtual organisations.

Distance Learning Institutions have in a sense always been "virtual" institutions. You cannot go to see an entire institution - certainly not in one place. They exist as a set of *virtually* aggregated sites, people, and functions, and not as *physically* aggregated sites. A virtual campus is simply a set of connected sites and functions, some permanently situated in particular places, and others not – some dedicated to the institution, and others not. It is their functions and their connections, rather than their (dispersed) physical and geographic siting that defines them.

Initially this came about by force of circumstance. "Distance" education arose in a sense because people could not get to the (then more desirable) single, physical campus, and so other means (initially thought of as inferior) had to be found. Distance Education was an alternative, niche market. Later on, people saw that distance education could be as good as (or better than) residential education, and realised that the flexibility it offered was a virtue in its own right, not a second-best necessity, and that it could be expanded into many other areas. The term "Open" learning captures this revalorisation of that flexibility.

In a similar vein, some Open learning institutions have started to realise that the flexibility now offered by ICTs allows this flexibility to be taken another quantum level up, to "virtual" institutions. At the stage when the technical potential for connectivity is approaching unlimited capacity, and the costs of communication, storage, and processing are constantly being driven down, the limiting factor becomes people's ability to design and use that connectivity. Flexibility is then complete. And purely "residential" learning becomes a niche market.

Virtual Institutions

It is useful to think about what characterizes virtual institutions, in education as well as other sectors. There are lessons to be learnt across sectors. These include the fact that although virtual institutions are a logical extrapolation of existing institutions, virtual institutions do not just *grow* naturally and painlessly out of physically defined institutions. They represent huge changes, and require large amounts of restructuring and change management, none of which is inherently pleasant, even though it might be exiting and interesting for those who take it forward.

Virtual institutions are defined by the connections between functions and resources, rather than by physical proximity or aggregation. Information and communication systems are crucial. These ICT systems reach their full potential for virtual institutions when they are based on pure data – when they are just the 1's and 0's (or *on* and *off* 'states') of fully digital communication and information. They are then purely virtual, in that they only exist as information when they are connected to a display or read by another device. In this form, data can be stored, processed and transmitted at an ever decreasing fraction of the price of previous media and technologies.

Similarly, people in a purely virtual organisation are not part of that organisation unless they are connected to a request to carry out a particular function or to supply a particular service.

There are other, derivative, characteristics of virtual organisations. Relative to their historical and institutional predecessors they can be, and frequently are: unbundled, outsourced, and many of the costs are externalized. They have different capitalisation, investment, and risk management strategies; they serve very different and new markets, and define their (core) business, and costs and revenues very differently too. The are to varying extents part of the dot.com environment, in which organisations and clients come and go at worrying speeds.

This gives us something of a picture of what digital ICTs and virtual organisations have to offer, how they are connected, and how different they are from their predecessors.

3.3 Connections for Learning

Given the potential of virtual institutions and digital technologies, we need to get back to the issue of developing learning systems.

The "knowledge society footprint" in Mansell & Wehn [ed] 1998 is a useful tool to track a country's development as a knowledge society. It deals with the issues at a multi-sectoral country level, with emphasis on industrial and macro-economic developments. The *Connections for Learning* map constructs a different kind of map, specifically for learning. It is designed to show how systems choices and learning choices interact, and more specifically how infrastructure, media, management, and Open learning are related from a country, institution, or learner point of view.

Like the Mansell & Wehn footprint, it does not provide right or wrong answers to ICT development, or learning. What it does provide is a map which, taken together with the Mansell and Wehn footprint, should give us a fairly holistic picture of what is happening , what strategies might be pursued in any particular situation, and how strategic choices in systems development could relate to strategic choices in developing learning opportunities and learning environments.

The Connections for Learning Map is presented below, with two initial "'mappings" for the University of South Africa (UNISA), one of the "mega-distance institutions". The first maps out the footprint for UNISA's urban middle class learners, and the second for UNISA's rural learners. It is evident that although the systems parameters are far better for the urban middle class learners, little has been done in terms of achieving the potential for learning in the top half of the map. For rural learners there is little, apart from broadcasting, (which is only slightly used by UNISA) in the systems section, and again, little has been developed in the learning section.

The function of such a mapping is:

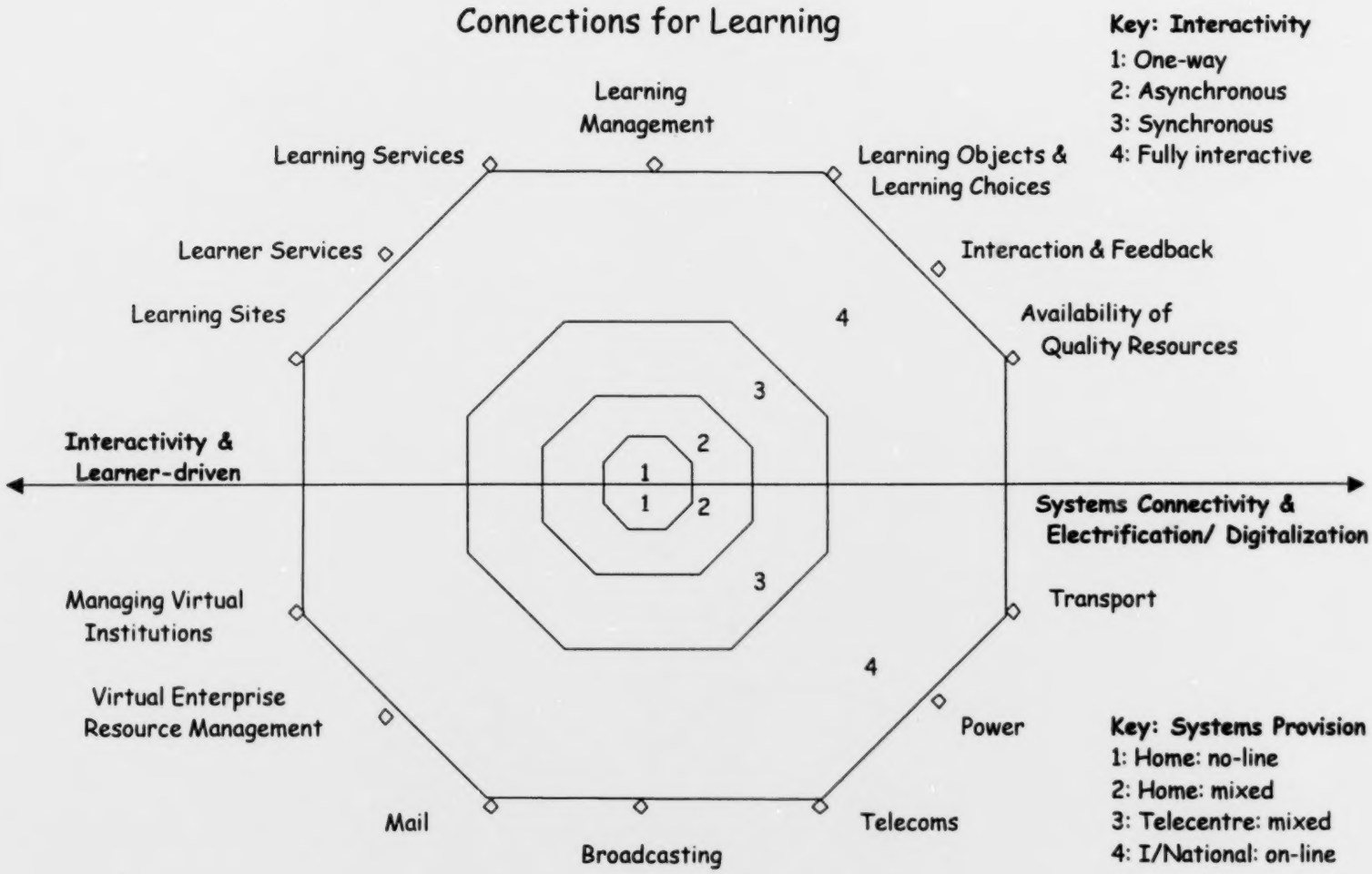
- To create a picture of the systems potential for learning, against the actual utilisation of that potential to achieve possible learning targets and goals.

- To enable strategic, planning, and evaluative conversations to take place around such a mapping exercise: at learning programme, institutional, inter-institutional, and country/regional levels.

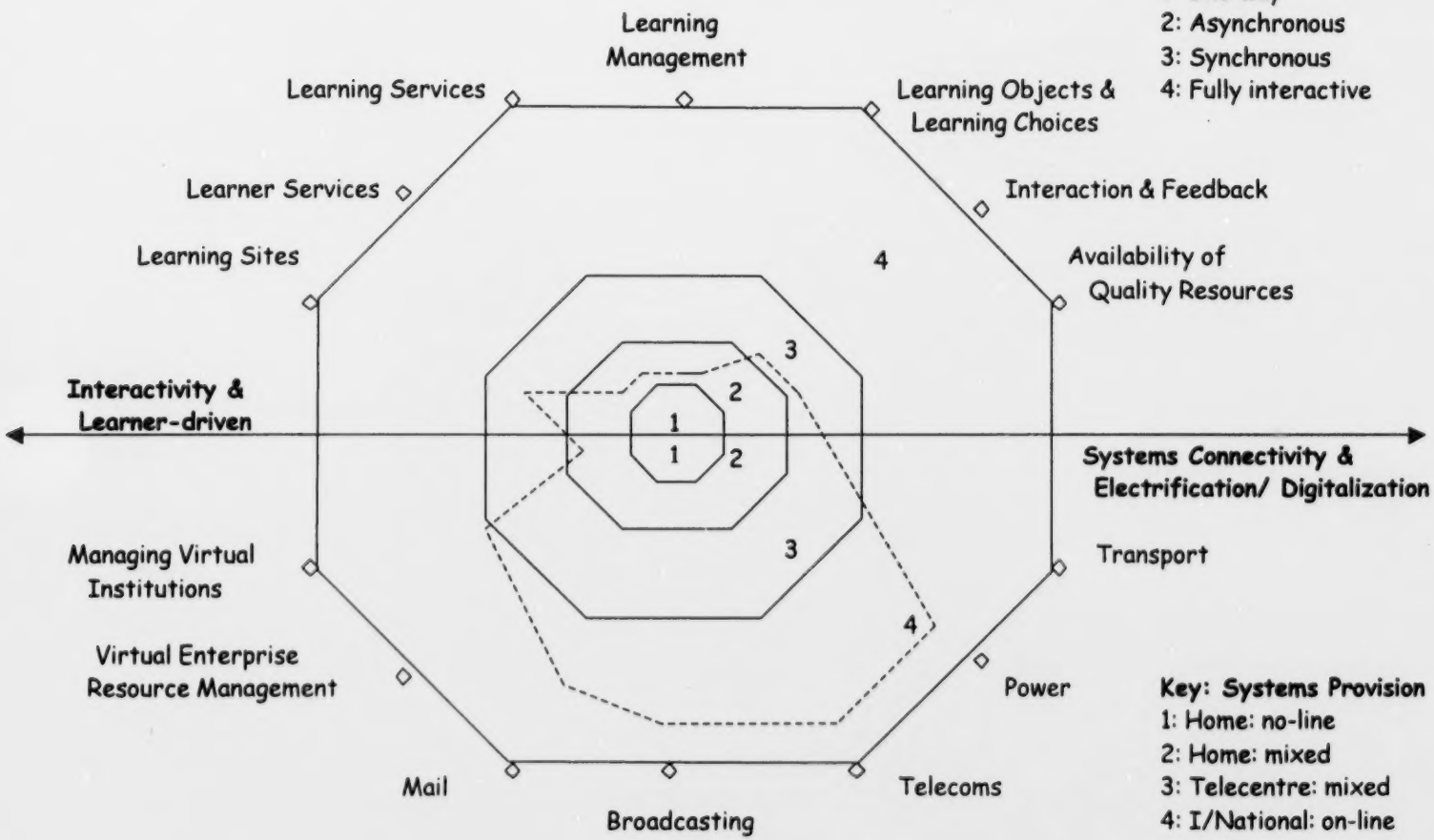
- To enable strategic, planning, and evaluative conversations to take place around such a mapping exercise: between those primarily concerned with learning (educators, materials designers and learners) on the one hand, and those primarily concerned with systems – both infrastructural and management systems on the other hand.

The rationale for the structure of the mapping, and some initial discussion of some of the issues concerning each of the map "points" or "vectors" (they are all vectors from the zero development in the centre, to the ideal developments on the circumference) follows. The map's value will be in its use, and application to actual institutions and strategy and planning.

It should be revised and restructured according to the use, and context. It is no more than a first draft of a strategic tool, which hopefully will mature with use.


Connections for Learning
Key: Interactivity
1: One-way
2: Asynchronous
3: Synchronous
4: Fully interactive
Learning Management
Learning Services
Learning Objects & Learning Choices
Learner Services
Interaction & Feedback
Learning Sites
Availability of Quality Resources
Interactivity & Learner-driven
Systems Connectivity & Electrification/ Digitalization
Managing Virtual Institutions
Transport
Virtual Enterprise Resource Management
Power
Mail
Telecoms
Broadcasting
Key: Systems Provision
1: Home: no-line
2: Home: mixed
3: Telecentre: mixed
4: I/National: on-line

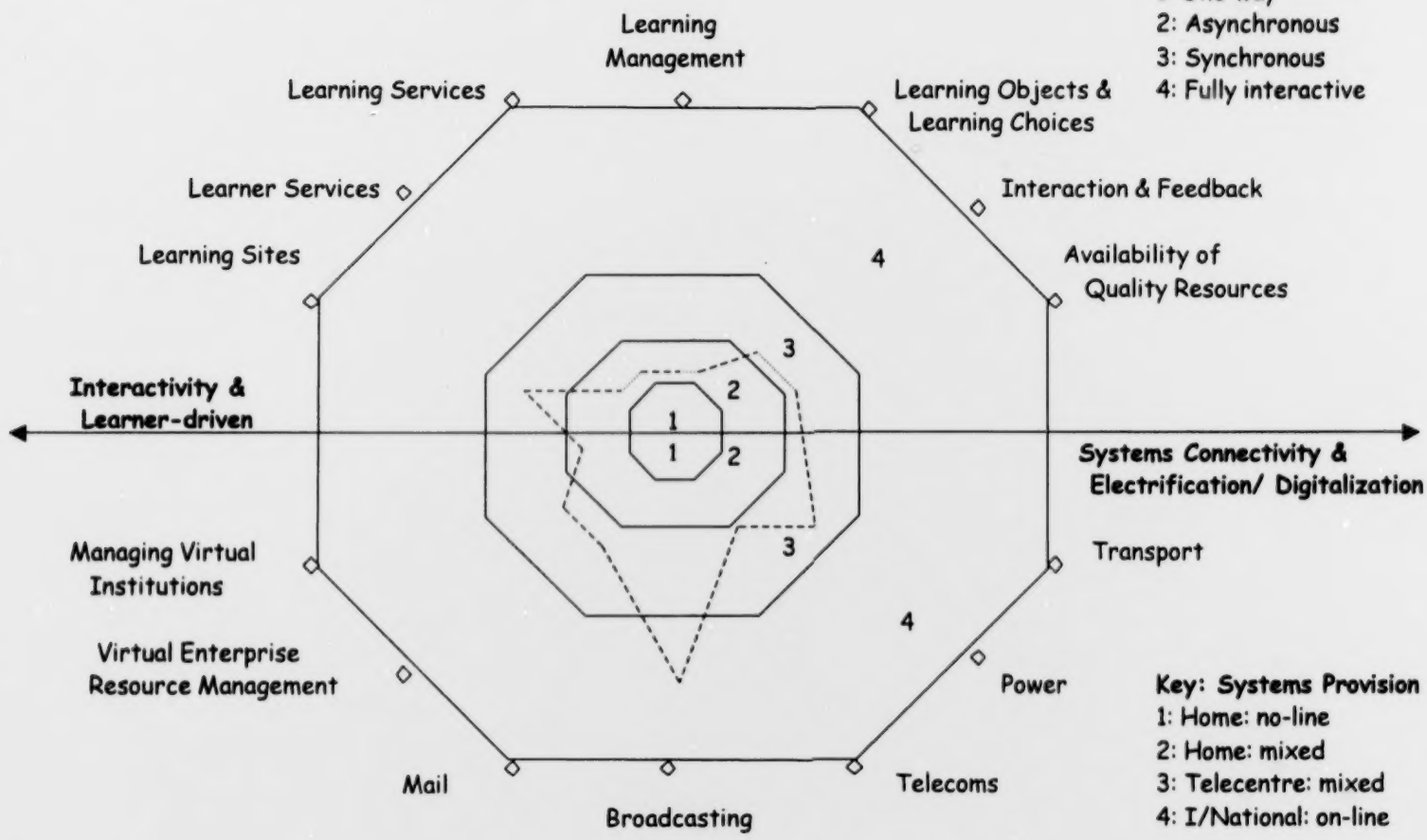
Connections for Learning: UNISA Urban



Key: Interactivity
1: One-way
2: Asynchronous
3: Synchronous
4: Fully interactive

Key: Systems Provision
1: Home: no-line
2: Home: mixed
3: Telecentre: mixed
4: I/National: on-line

Connections for Learning: UNISA Rural



Key: Interactivity
1: One-way
2: Asynchronous
3: Synchronous
4: Fully interactive

Key: Systems Provision
1: Home: no-line
2: Home: mixed
3: Telecentre: mixed
4: I/National: on-line

Learning environments and systems.

The map is divided into a two halves: Learning Environments, and Systems.

Learning Environments

The top half represents the development of learning opportunities and learning environments, for learners and for educators. This proceeds from one-way, top-down supply of services in the central frame to fully interactive, demand driven, globally available services in the outer frame.

Communication in the central frame is one-way. There is little or no feedback, and provision is entirely determined by the institution. It is supply-led with little choice. It is institutionally controlled, and could be seen as an abuse of a monopoly supply position. In frame two, communication is interactive between the centre and the learner, but only asynchronously, within narrow parameters, and infrequently. The third frame includes synchronous interaction, but also within narrow, institutionally defined parameters, although these start to include more learning services. The fourth frame is fully interactive, uses synchronous and asynchronous interaction, is largely learner-driven, and provides the fullest range of services, as required by the learner.

Systems Connectivity

The bottom half represents the development of connectivity in systems (and electrification/digitisation) – both in infrastructure and in management and information services. As you move out from the centre the ability to connect, and the area in which you can connect with others increases.

The central frame is the home, with rudimentary connectivity: some message capability, either on foot or through a patchy postal system, with the doubtful possibility of an inaccessible telephone some distance away. The second frame is the home with some connectivity provided by the household itself. Telephone, power, and transport, and even ICT connectivity can be provided here, but without the benefits of affordable, reliable inter/national systems. The borders of the third frame overlap with the second frame. It includes some additional local provision, though telecentres and the like, and provides wider connectivity. Only in the fourth frame do we get into the "developed" country mode, where connectivity from home, mobile, institutions, and telecentres is comprehensive.

There are a number of critical success factors that are important for the development and management of an open learning system, from the point of view of the learner and the educator. These include:

- Availability of quality learning resources
- Interaction and feedback within the programme
- Learning ("i-site") management
- Learning services
- Learner services
- Learning sites.

Learning Environments

There are a number of variables that can be used to define the learning opportunities, or the learning environment. The overall variable is that of increasing interactivity and learner-driven systems. The two are inter-linked. Interactivity is not an end in itself, and although some interactivity is essential to both learning and teaching, some learners choose to interact more than others. What is important is that a full range of opportunities for interaction should be made available if at all possible.

Availability of Quality Learning Resources

There are a number of ways to make learning resources available. Print materials will always have a role – they are portable, generally affordable and if well written and designed, are very useful as basic texts. In the selection of additional media and technologies it is important to first identify the learning objectives, and the learning requirements. Media choices and financing should follow need, and not vice versa.

For instance, where quality language examples are needed, interactive radio can be used. Both radio and television are good "general knowledge" media for mass audiences. The Internet is useful for current information, particularly if the source of the information, or the users for that information are spread over large distances. Information on current issues and crises, like AIDS, is best substantially distributed on the 'Net.

Cost

If materials are to be available in practice, that usually means they must be affordable too. That is why print has ruled the roost for so long. But these things change.

In mid-year 2000, the thriller writer Stanley King started publishing some of his stories on the 'Net. First he published a short story, for which you had to pay up-front, and he made money fast. Then in mid-year he published the first two chapters of a novel, and asked for a voluntary contribution of US$1. He threatened to stop writing the story if less than 75% of the audience refused to pay. Over 78% paid: a gross of US$32,000 in less than 24 hours.

There are various providers who are putting up entire curricula for free, in a typical dot.com strategy, hoping to make money on the related (tied?) services. These initiatives change your options. If you want to read Stanley King's thriller as it hits the 'Net at 00h01, you read it on screen. If you want to have a complete record of your learning resources, but only read some of them some of the time on paper, you might choose the electronic version when it comes to time to pay.

So the issue of the availability of quality resources now depends on the relative merits of print (which might be "costly"), on-screen resources without a printer, or even worse, "Web-TV" at scratchy resolution, or on-SVGA/LCD-screen resources with printer and Gigabytes of storage, and on the willingness of the user to absorb externalised costs. And this is in turn influenced by whether the information becomes "dated" quickly, and whether additional up-dates are worth-while. These factors then interact with the costs and convenience of using the information on-line or off-line. The statement "no one would choose to read long texts on a computer screen" is now both true and false. True in an ideal world, but increasingly false in the real one.

Access to quality resources is complicated. Costs, product convenience, convenience of access, and reliability of systems support all interact.

Interaction and Feedback for Learning Programmes

This is essential for learning and for teaching. Reading a mass produced text book (with or without study guides), or reading mass produced *bookware* on screen is not adequate. The complete "stand-alone" packages had not yet been invented, as anyone with a software manual in hand will attest. Asynchronous, and even better the addition of synchronous interaction with a mixture of tutors, peers and computers in a variety of media, including face-to-face, is necessary and efficient.

Many of the modes of interaction are being absorbed into the long awaited "convergence" of media in the new digital world. Connectivity via the kilo bandwidth of the internet and the mega bandwidth of the superhighway (for those who have it) can in principle put most people in touch most of the time.

What is required (again) is the specification of the learning objectives, and of the costings of alternatives, many of which are cost-effective only across existing institutions and even government sectors (e.g. health, education, safety and security etc). Some choices are surprising. In South Africa the ASECA adult open learning programme decided in 1994 to use a courier service instead of the post, as although it was more expensive, it was much quicker and much more reliable. Costs could be shared by learners.

The frequency and speed of feedback is often cited as critical for open learning. This is not merely a matter of technology, as many users of email will attest. The potential for feedback is already overwhelming. We need to map out, and find the best "fit" between alternatives, for learning goals and systems costs and efficiencies.

Interaction for Everyday Life

In the past the interaction for learning programmes and interaction for everyday life has been quite distinct and separate. But as information becomes more accessible, and as information providers and services multiply exponentially, the two overlap, and the margins blur or disappear.

On the positive side, learners and educators can make useful links between interaction and resources for learning programmes and for everyday life. What this does is to remove the glass barrier between what is learnt and what is useful in formal education, and what is useful in life outside the programme and the institution. It includes email and internet use and management, as well as the management of information content.

On the negative side, 'Net surfing and chatting can be as counter-productive and expensive for the people who pay for the system as adolescent use of the home telephone.

Learning Objects and Learning Choices

Learners in open learning systems are increasingly offered choices. Choices between institutions, (such as MBA courses) and also choices to take and combine courses from different institutions, and even combine them across distance and residential institutions.

There are new developments which can take this far beyond what we have now. These developments include: modularisation and granularisation of learning objects, curriculum and qualifications frameworks, course design, platform-responsive display and interaction, materials design, coding design and protocols, and knowledge base design and construction.

Learning objects

These are the basis for the next generation of information and knowledge management, and are based on XML (extensive markup language). In addition, VML (Vector Mark-up language) will offer greatly enhanced elegance and economy of the coding of graphics, allowing storage and transmission of graphic images at a far more efficient level.

XML is one stage beyond HTML, which is the standard 'Net coding system. XML will still output and display in the same way, i.e. as HTML, but it is coded differently and offers vastly different and improved facilities. In simple terms, it adds another layer to the coding of HTML: it codes the **type** of information as well as the content. In other words, information could be coded as addresses, publication titles, etc. This allows more sophisticated functions to be performed using the data. These include:

Sorting far more finely, and with greater precision in search commands.
Attaching and coding information by types of information
Combining and recombining learning objects by instructions on the 'Net (using any standard browser).
Designing learning modules (or granules, as they can be much smaller than what we are used to describing as "modules") in small units. This means in turn:
Designing learning materials so that they can be combined in a great variety of ways, for a great variety of purposes. This offers the possibility of learning on demand, as the learner just as much as the educator can specify the requirements for the combinations of modules or granules.

This will offer increased flexibility for materials designers, who will be able to use and reuse "granules" across applications.

Assessment

It does however pose considerable challenges for assessment and accreditation. All modularisation is a challenge for assessment, and *granularisation* will be even more so. It will be interesting to see whether assessment can be broken down into units as small as the granular content units, and even more interesting to see whether assessments can be combined in the same way.

Platform responsive display

XML and object oriented content/materials do allow for *platform responsive display* which means that the data is held in one, extensively coded format, but can be displayed in different formats according to the display device. The display device could be a browser on the internet, email, a fax machine, or even a "WAP" mobile phone and in principle a machine-voice audio appliance. Each display would be slightly different, but the data would only be held in one coded form on the data base. The current HTML format, which is platform independent (as opposed to platform responsive) is a very good one-size-fits-all compromise for a basic system. But it has served the purpose of getting a mass audience established quickly and with little or no training. The same can be said of Auto Teller money machines, and to some extent email, although email has gone through its own developments, and is a little more sophisticated than it was to start with.

In the developing world this means that if a combination of media and services are used, the user will not necessarily have to have access to a computer, or any computer skills, to get a response. A phone call to a telecentre, or "info-shop" could pin-point the information required, which could automatically be sent and printed off on a fax machine at a remote location.

Coding Protocols

XML does however require more coding, and agreements on coding protocols. Various people and institutions are working on these, in business (BIZTALK) and education (TML: Tutor markup language). This will require a lot of work, but fortunately it is likely that the protocols will not be proprietary, as they will only work if they are the product of agreements between large numbers of organisations. (See also Parish & Parish 2000, cited in Farrell G, personal communication).

Learning Management

Learners have for ages been required to manage parts of their own learning. They have to take notes, copy down drawings and exercises, relate them to text books, and make decision about what and how to learn and revise for exams and tests.

The very real possibility exists now for learners to manage their learning comprehensively. Learners could shift from their current rather dependent and passive roles into learner-driven or even *virtual-client-driven* learning. This is both because of the technological possibilities, and because of market pressure. Current technology allows resources of 160,000 pages to be printed on a CD-ROM for $2, and then thrown away and replaced every few months. Market pressure is providing whole curricula of text book material for free on the 'Net, and linking this to many other services, some of which will be free, others exorbitant.

Learners can in principle already be offered their entire curriculum free, in bookware or better. They can also access copies of top grade essays for past assessments. If the future is the *knowledge society*, the opportunity to learn to manage knowledge must be an integral part of any learning programme.

There are two new modes of managing learning (of "i-sites") which can facilitate this: individual and institutional, and the two should be linked.

i-sites

i-sites are a new concept in the crowded world of "inter- intra- and extra-nets". They are sites for individuals, or sites which are intermediary sites (not portals). They might be held on intra- extra- or inter-nets. They are not structurally defined, but functionally defined, for users or groups of users.

Individual i-sites.

It is useful to define what is possible, and what might function as a goal, or even an ideal – for developed and developing societies. Ideally an individual i-site would be a site where a learner would be given space on a server to keep, maintain, and customise their individual learning resources - for life. In a sense it is nothing new, but merely an extrapolation of what is already happening. *Hotmail* does this for limited email use, and individuals who bookmark *favourites* on the internet do something similar too. It could also, in principle, be done on other non-virtual media, but with different benefits and limitations. The optimal configuration would be to do it on a virtual i-site, with non-virtual outputs (like CD-ROM and DVD) if required.

The learning institution could down-load onto the i-site a copy of all the resources relevant to that person's courses. The individual could choose to keep very closely to what was given to them by the institution, but they could customise, add to, delete and change the resource to suit their needs. If they had access to this on a Web server, they could continue to use this regardless of whether they changed the place they lived, worked, their learning institutions, or courses. It would be a truly versatile i-site, and would greatly expand the concept of "learner-centred life long learning". It also challenges the possibility of, and the nature of, institutional loyalties (see the section on restructuring the institutional landscape below).

And it creates a new relationships between the server and the client, by introducing a *middle layer* or an *intermediary* layer, to do some of the work of *mediation* that is such an essential element of all learning. (The educational literature often refers to mediated learning, or mediated learning resources, or human mediated learning and even on occasion, machine/computer mediated learning). The difference would be that more of this inter-mediation would be done by the learner themselves.

Intermediate i-sites

The second type of i-site is the intermediate i-site. This is set up and managed by the educator, and/or the educational institution. It consists of a set of educational *mediations*, or route-maps, or guides, and may or may not contain large amounts of content, and extensive links to web-sites. (This depends on the relative merits and costs of on-line and off-line interaction). It maps out the currently known, and reviewed, resources for learning for the courses and issues that are of concern to that institution and its learners, and contains content as appropriate and feasible.

This may sound like it would be done by every school, or university, or at least every distance education institution - not necessarily so. There will be existing institutions which choose to do this, and are capable of doing so. But the most appropriate "institution" will probably be a different kind of institution, or an inter-institutional agency of some sort – public sector, private sector, or hybrid. One of the factors to keep in mind is that current institutions might have to change quite radically, and go through many hybrid forms before settling down into new institutional forms.

There are two important functions to consider: designing a knowledge base/knowledge resource for specific groups of learners and educators, and planning and operationalising the most appropriate technical and financial means to achieve this. This could include the use of some or all media: from print to broadcast, to on-line and off-line Web resources, conferencing, etc. It is in a sense some of what librarians used to do: the management of learning resources. The differences are that it should be done in an integrated manner – Integrated Enterprise Resource Management, and that it could be completely revised and changed as often as the need and capacity is there to justify doing so.

Ideally the two i-sites should *talk to* each other, i.e. allow easy transfer between them, and be compatible in format. This will take some effort, and the learners and educators will have to talk to each other about the design and usefulness of both sets of i-sites. Both learners and educators should have the opportunity to contribute to the content and architecture of i-sites, and for their contributions to be recognised and rewarded appropriately.

This would contribute to developing the Web as a more "mature" technology, i.e. one which starts to become differentiated into different uses and functions. Initially it was used largely as a global "land-fill" site, or "information-dump" site, and for basic publishing and communication. Now it is being used increasingly as a specialist B2B (business to business) and B2C (business to client) medium for financial transactions. The C2C (client to client, or P2P: peer-to-peer) role is largely confined to email. Individual i-sites are C2(same)C, and intermediary i-sites are a kind of retail-B2C type, but with far more "client" (i.e. learner) input. And the intermediate i-sites could usefully be distributed in off-line media to the clients, to become the basis for individual i-sites.

Within a Web technology environment there are lots of possibilities, on-line and off-line. However, the principles of developing i-sites could also be applied to other media, and could be applied to non-web resource management. As and when the technical and financial factors develop, more digital options could be pursued. But it is a strong argument for digitising other media in anticipation of these kinds of developments in the future. One good example of a hybrid application was the production and distribution of 3-D animations for school physics, produced by a teacher at Maru-a-Pula school in Gaberone, in Botswana. They were distributed on floppy disks – one animation to a disk.

i-sites for Everyday Life

i-sites should serve specific purposes within learning programmes. But as was mentioned in the section above on Learning for Everyday Life, the requirements of learners are not restricted to learning programmes, and the information and sources of information that they access and use are not neatly divided into *Learning Programmes* and *Life* sections either.

There are two issues here: the overall concern of the learner, which is often for information and knowledge for everyday life, within which learning programmes are just a part, and the issue of the relationship between information for learning and for application in everyday life, including the working environment.

Now clearly not all learning programmes and material are directly vocational. The issue is rather an issue that applies to knowledge bases in general. Namely: How does information on a knowledge base (and i-sites are at least proto-knowledge bases) relate to the knowledge practices in the world of work and everyday life? It is firstly a matter of learning architecture, and then a matter of content. (The content

might be very similar). But in order to be useful, knowledge bases need to incorporate some elements, or some front end options, which relate to actual *knowledge practices* in the world outside of learning programmes, which just means the ways in which knowledge is actually used. It would be useful then if i-sites, and programmes to assist learners in managing i-sites, took some cognisance of the requirements of working knowledge bases. (There was a useful example of this at MEDUNSA, the medical university in Garankua, in South Africa, where it was demonstrated that in a paediatric cardiology course there was a major difference between the way in which the medical knowledge was presented and processed in clinical and pre-clinical/academic settings).

Learning Services

These are services that are closely related to the learning programme. They include prior learning assessment, placement, counseling, career path planning, and self-assessment. Basic versions of these services can be offered in various media, preferably with synchronous and face-to-face backup where necessary. Large amounts of basic services and back-up can in principle be shifted onto these media. Their value is in the connections and links to people's needs, which means that the cross-over from computer information and interaction to human interaction and services is crucial.

The provision of new forms of library loan, such as on-line libraries are providing interesting cost-effective options (see the African on-line library at Technikon SA).

Learner Services

These are services that do not have to do with learning as such, but with all the other things that learners have to do. Book purchasing could be included here, or as part of Learning Services. It depends on whether the institution sees itself as fulfilling that role, and whether the learner can get a better package of services from another institution which would include it. In some cases, like this one, some of the services might already be provided by outsourced partners or commercial organisations such as Amazon, which the institution could negotiate with, with a view to providing a linked service, and a share of revenue as an "associate".

But there are wider implications.

One of the characteristics of virtual/information societies is that institutions redefine their "core business" or have it redefined for them by the competition and the clients (learners). Many businesses (such as retailers) are becoming major financial service providers (UK and South Africa) and internet providers (UK). For some of them the traditional retail business (clothing, electronics) can become the minor part of their business, as financial and information services grow.

Students in the tertiary sector are prime targets for recruitment into various financial and information services, and Open learning institutions are well placed to offer these within an integrated package, including credit and loans. This does not have to be done by the institution. It could be done in an outsourced partnership. But it redefines the services the institution offers, and more importantly redefines *the way in which the services are defined*. Namely, the client (learner)'s needs start to define the

mix of services, and the "core business" of the institution, which is defined in terms of what the learner demands, rather than what the institution wants to supply.

Virtual-client-driven education

If we consider some of these factors together (learning management, Learning Services, and Learner Services), what we arrive at is a radically different picture from conventional education. It is a picture of learner-driven, or *virtual-client-driven* education. This is quite a few steps on from the more conservative *learner-centred* education model.

The cycles of educational programmes are longer and slower than other sectors, so we are not going to see learners *mouse-clicking* from one institution to another in mid-course - at least not soon. What we are already seeing are learners clicking from one course to another for their initial selection, and in some cases a majority of selections for a programme being done on the 'Net. Where *e-commerce* market pressure is applied to the educational sector, it will be no different from other sectors: tough, rapid, and unforgiving.

Learning Sites

Telecentres have been developed in many countries. Their development has seldom been planned with Open Learning in mind. What is also widespread is the lack of co-ordination between learning sites, even when they are offered in the same place by several institutions, all of which are in the public sector. South Africa is a case in point. There is an interesting argument for all Open Learning sites (public and private sector) to be required by the State to abide by an equivalent of the telecommunications "common carrier" obligations, where all providers can use parts of each other's facilities, under well defined limitations and tariffs.

This would logically include residential and Open/Virtual institutions. There are also additional opportunities, for instance the pharmacy chain in the UK, *Boots*, has entered into a partnership with Pro-change, a health promotions charity, to provide sites for the Pro-change smoking programme, which is CD-ROM based, and is a (non-formal) Open Learning programme.

And again, the learning objectives (in this case access to the appliances and connectivity, and perhaps some on-site services) need to be specified, and the technical, financial and institutional means sought to try to satisfy them. But these objectives and their solutions do not fall easily within the boundaries of existing institutions, or government sectors.

There is a need for policy and for regulatory effect to be put in place in terms of "educational/learning catchment" areas, which in some countries might be in place, and in others not. Invariably if they do exist they are in place for some educational sectors (primary and secondary, for instance) but not for others.

Systems connectivity

The variable of Learning Sites is in many ways also a Systems variable. The reason it has been included in the Learning Environment section is that the overall variable for that section of the strategic planning map is that of increased interactivity and learner driven provision of services. And it is important that both those parameters are considered when considering the issue of Learning Sites.

This section will now consider the key systems parameters for supporting the development of interactive, learner-driven learning. These include: transport, power supply, telecoms, broadcasting, mail, communications and information (change) management, and the (change) management of virtual organisations.

Transport

Three things need to move efficiently in open learning: the learning materials, the feedback and assignments, and if possible people who meet at least initially, face-to-face. Transport of people, materials, and information is necessary. Road and rail networks also benefit the development and support of other *connectivity* sectors, such as telecoms. Some of the combinations can be very powerful – such as rail and telegraph in the early days of telecommunication.

Power

Learning benefits from the provision of lighting, electronic media, electronic communications, etc. Digital media are reducing power requirements and consumption, and solar, wind, micro-hydro, wind-up, and new battery technologies can provide the basis for new hybrid forms of power supply, even in remote areas.

Telecommunications

Telecommunications networks, including the traditional twisted copper wire telephone network as well as satellite, microwave, and now wireless *last-mile* as well as wireless mobile services make connectivity possible to more remote areas. Digital networks, and high bandwidth networks, particularly fibre-optics, are more versatile, cheaper, and require less maintenance.
The financing of telecommunications development is complex, and interacts with national and international telecoms and trade regulatory policy. The use of internet technologies for education in particular requires specific tariff structures and long term infrastructure investment commitments that are very unforthcoming in most countries. The networks, the capacity to manufacture or import hardware, and the technical skills to operate and support the technology are also all critical. Mansell & Wehn [ed] 1998 deal with most of these issues in detail.

Most education is provided in most countries within the public sector. But most of the facilities for participation in the virtual society are increasingly provided by the private sector, which is not in the public sector business of equity, or infrastructure for people with little disposable income. Hybrid, outsourced, mixed-sectoral approaches are required. For instance, telecentres in South Africa have been

developed in a project involving the University of Witwatersrand's Partnership Programme and the LINK project, and the Internet Learning Trust in the UK. The school computer centre is used by the school during the day, and for ICT training for the community, as a revenue centre, after hours. Open learning use of the centre, (in an internet café mode), could add to the revenue and educational use of the facilities.

But these are not trivial *add-ons* for the institutions concerned. They are large shifts in what the institutions do, require shifts in management expertise and personnel, and introduce very different, competing needs and benefits which are in many ways contrary to the values of public sector education. And as with many of the other changes discussed in this report, these changes do not always respect or fit within the boundaries of existing institutions.

Often they require hybrid and then new institutional and inter-institutional and inter-sectoral forms to achieve affordable and sustainable learning goals. The telecentre project referred to in the above paragraph, for instance, operates a training and support (technical and management) service across up to 25 centres within one "unit". Both skills and facilities need to be shared and costed in cross-institutional agreements.

Broadcasting

Audiences and users of broadcasting and telecommunications have been split and recombined into many hybrid forms. It is now possible to find "broadcasting" and "telecommunications" technologies used interchangeably for point-to-point, narrow-casting and broadcasting purposes.

But there are still particular mass audience requirements at district and national level, and WorldSpace has launched international educational radio initiatives for developing countries, based on direct satellite radio broadcasting.

In a slightly different format, community radio, and audio and video programmes are increasingly being used as the technology becomes cheaper, more reliable, and as other aspects of the infrastructure (e.g. wind-up radio, connection to satellite broadcasting, and solar power) become affordable. This is particularly true of initiatives in which a P2P (peer to peer) or broadly participatory model is used. This facilitates *learner-driven* programmes, as the learners not only specify the learning objectives, they can actually do most of the materials production themselves as well.

Mail

This includes *snail mail* (letter and parcels), *email*, and courier services. The parcel and letter post will be used increasingly for the derivative products of the new electronic media, and find new hybrid and then niche functions. e-commerce rapidly increases "mail-order" parcel traffic, and posting CD-ROMs and DVD disks could become a new mass mailing/publishing medium in areas where it is too expensive or takes too long to set up fast, reliable telecommunication networks. Post offices are very wide-spread. In some places they are the most wide-spread public sector point-of-presence.

Even the recent and much contested unbundling of postal services and telecommunications services in many countries could be usefully restructured, again, so that better use could be made of these points-of-

presence: for ISP(internet service provider), email, telecentre, and open learning purposes. This would involve the restructuring of recently restructured institutions, in which institutional form responds (or refuses to respond?) to function and to customer demand.

Virtual Enterprise Resource Management

In the section on availability of quality resources, it was said that:

> Access to quality resources is complicated. Costs, financing, product convenience, convenience of access, and reliability of systems support, all interact.

Traditionally these variables, and the scale and domains within which they operated were fairly well established and stable. Pint runs had to be a few thousand to be viable, and several more thousand to be discounted. Across an educational system (country, province, etc) that worked. Print was as they say "the only game in town". This is no longer necessarily the case.

Managing the resources for learning has moved on. Libraries and catalogue systems are now search and browser systems. There has been a progression from card catalogues to data bases, to expert systems, to knowledge bases and knowledge management. Knowledge management itself is developing into more user-driven systems, in which the development of the knowledge base is increasingly dependent on an analysis of knowledge practices and knowledge frames - quite simply: What use do actual people make of information, and within what actual contexts? The designer of a knowledge base also has to interact with developments in human resource development: new ways of defining jobs - including *tasks, skills, and knowledge*, and new ways of defining institutional outputs - *value-chain analyses*. These are complex and expensive exercises, and the field as well as the skills required for *knowledge management* are still being defined.

The nature of resource management changes as very different technologies, economies, and human resources become available. On-line as well as off-line (CD etc) resources offer different options for resourcing learning, in different ways, with different financing structures, and with different copyright parameters. The incremental costs of distributing and reproducing information are so low that some well financed and/or commercially aggressive institutions will be able to create and maintain market share by giving it all away for free. Encyclopaedia Britannica and Microsoft Encarta have fought a price war going all the way down to free Web access, from an initial price for Britannica of thousands of dollars.

The managers of learning resources and learning institutions have to be able to make choices about the combinations of learning objectives, learners, and institutional alliances and agreements, in relation to the combinations of technologies, economies, and financing available. There is still a role for distinct IT management, but general management is now required to be conversant with all the combinations of, and interactions between technical, institutional and educational factors.

Managing Virtual Institutions

The benefit of a virtual institutions is that in its fully developed virtual form, with all the systems infrastructure and connectivity in place, and much of the work outsourced connections can be made, resources mobilised, and services provided and changed quickly and decisively. But then the same applies to the competition, which might offer some of what your institution thought was a secure revenue base, to the market place for free.

This prompts some rethinking about the nature and financing of public sector services, the notion of "free" education: the relation to and response to private sector marketing and competition, and so on. It also prompts a lot of thinking about national and international policy and regulation, copyright, and international credit and commerce.

Costs, Costing, and Financing.

One of the crucial issues identified in the survey, in phase two of the project, was the issue of costs. Costs were widely found to be the *single most important limiting factor in the diffusion of appropriate technologies for learning.*

However, the question is fairly tautologous. As an institution in the public education sector, if you are asked whether you would like to spend more money on new technologies, which are expensive anyway, the answer almost has to be "No". However, if the technologies are "appropriate" then surely this would mean that they are appropriate both for the user context and for the financial context? This is a problem, as the answer then has to be "Yes"!

Perhaps a more useful way to approach the issue is in terms of "costing and financing" rather than "costs". *Costs*, if they are seen as absolute, and as add-ons, are difficult to justify. *Costing* is a different matter. If institutions can be shown that different technologies, and more importantly different combinations of technologies, can be *costed* across time, across programmes, and even across institutions, to yield different and better learning and institutional outcomes, that is a very different matter. But it is not a matter of just considering costs. It involves financing, business plans, securities and servicing debts, and a host of investment and business plan and change management issues.

Critical Change Factors

One of the key characteristics of the virtual society is institutional change. Unbundling and restructuring, with the accompanying commercialization and privatisation is not new, but it accelerates in a virtual environment, particularly under pressure from the private sector's involvement is previously public sector preserves like education.

Many of the opportunities for using technology, from the Internet to community radio and digital video will only be made available to a wider audience, and particularly to poor communities, if hybrid inter-institutional and inter-sectoral initiatives are developed.

Many of these do not fit within existing institutions, and many of the new technical and managerial skills cannot be provided within current institutions and public sector job specifications. In many cases the

distinction between the public and private sector gets blurred, and new ways have to be found to ensure that public service values are maintained in mixed-mode institutions.

At a time when both developed and developing countries are privatizing in unprecedented ways, there also needs to be a shift from administrative law to regulatory law. The State can continue to promote equity and rights in a privatized society, but regulation is necessary. Most education has traditionally been administered within the public sector. Managing education in a regulated world needs new skills and new institutions at several levels.

4. Conclusions and Recommendations

There are three broad areas in which the work of this project could be taken forward:

- Strategic planning and policy
- Research and knowledge bases
- Demonstrating new approaches and models, and training.

The goal of the project was to determine the factors that were important for the diffusion of technologies for learning. The project has been successful in identifying a broad and fairly inclusive range of these factors.

It has also been able to start to demonstrate how some of these factors can be addressed, in the three field trials.

The issues and questions for further research that follow from the project gave rise to a number of particular questions, concerning:

- Country status and strategy as an information/knowledge society
- Institution status and strategy as a learning institution, and potentially as a digital/e-learning institution
- Macro critical change factors, and the way they impinge on learning institutions.

Additional sources were consulted, the issues were re-examined and where necessary re-formulated, and some strategic tools have been put together to provide an initial framework for dealing with some of these issues. These tools include the Mansell and Wehn *Footprints of country participation in Knowledge Societies*, and the *Connections for Learning Maps* for linking strategies on learning systems and learning outcomes.

Strategic Planning and Policy

The combination of the Mansell and Wehn *footprints*, and the Connections for Learning *maps* should enable countries, institutions, educators and even learners to develop strategies and policies based on an analysis of the learning opportunities they want to develop, and their relationship to possible developments in a variety of alternative systems. What is important is to be able to make decisions on the trade-offs between the alternatives: in learning outcomes, in systems/technologies and media, and between the two.

The *footprints* are important at a country and international level, and would serve the strategic needs at a Departments of Trade and Industry and at a macro-economic level. The *maps* also contain information and indices on infrastructure. However, these have been selectively "transcribed" to provide a systems perspective for connections **for learning.** And management issues have been added: institutional, ICT, and human resource management.

This makes up a *map* with two halves - the Learning Environment, and Systems. When they are juxtaposed in this way, strategy can be discussed across systems/ learning/ and management issues. The development (and "diffusion") of learning can be analysed and planned at learning programme, institution, and country level. In terms of Government Ministries, this map should facilitate an integrated discussion on learning strategy between all the Ministries involved in learning and in systems and infrastructure.

Research and Knowledge Bases

Research

There is a need for further research. At a micro level best practices still need to be documented, analysed and evaluated. At a systems levels there is, if anything, a much greater need to research *best strategy* rather than just best *practice*. A strategic evaluation (or impact analysis) needs to take all of the following into account: costing, financing, technology and systems, access, and the value of the learning. The new media environment makes it possible to do so many interesting things. The question is: Which of them are appropriate - for the present time, and to form a basis for future developments?

Knowledge Bases

There are always opportunities for building knowledge bases. But the question of appropriacy applies here too. At a relatively simple level, it would be possible to consider the following parallel developments:

The development of a set of strategic evaluation and planning tools. The *footprints* and *maps* could form the basis for this. They should of course be revised and developed and added to if necessary. They can be made available as a series of diagrams and texts.

Alongside these texts and diagrams - quite literally: on one side of the screen (on-line or off-line on CD-ROM media), it might be useful to set up a series of icons, just like the ones around any standard word processing screen, which would link to a series of examples of best practice (and best strategy). The icons could link to examples by: country, region, media & technologies, institution, government sector, types of communities (rural, peri-urban, etc), and education and training sectors.

This might usefully inform the conceptual and analytical texts in the strategic tools. It could be made available on- and off-line, at little cost, and updated in the off-line version a few times a year.

The Diffusion of Technologies project has explored a number of factors, and the questions and issues that have arisen from the project point the way to some useful areas of future work: in strategic planning, in research, and in the related development of knowledge bases.

Demonstrating new approaches and models, and training.

There is a demonstrable benefit to assisting institutions to consider, plan, and develop new approaches to learning, using different combinations of technologies and media.

The field projects demonstrated the value of raising awareness of new technologies and combinations of technologies. These projects as well as the work of the Commonwealth of Learning in other projects demonstrates the value of assisting people to take the next steps too: to do needs analyses, feasibility studies, and start-up and support, in order to build and demonstrate models of effective learning.

The crucial issue is to ensure that both the new development, and further training and support are sustainable, within a well costed, long-term scenario.

Appendices

UNCSTD Recommendations
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